

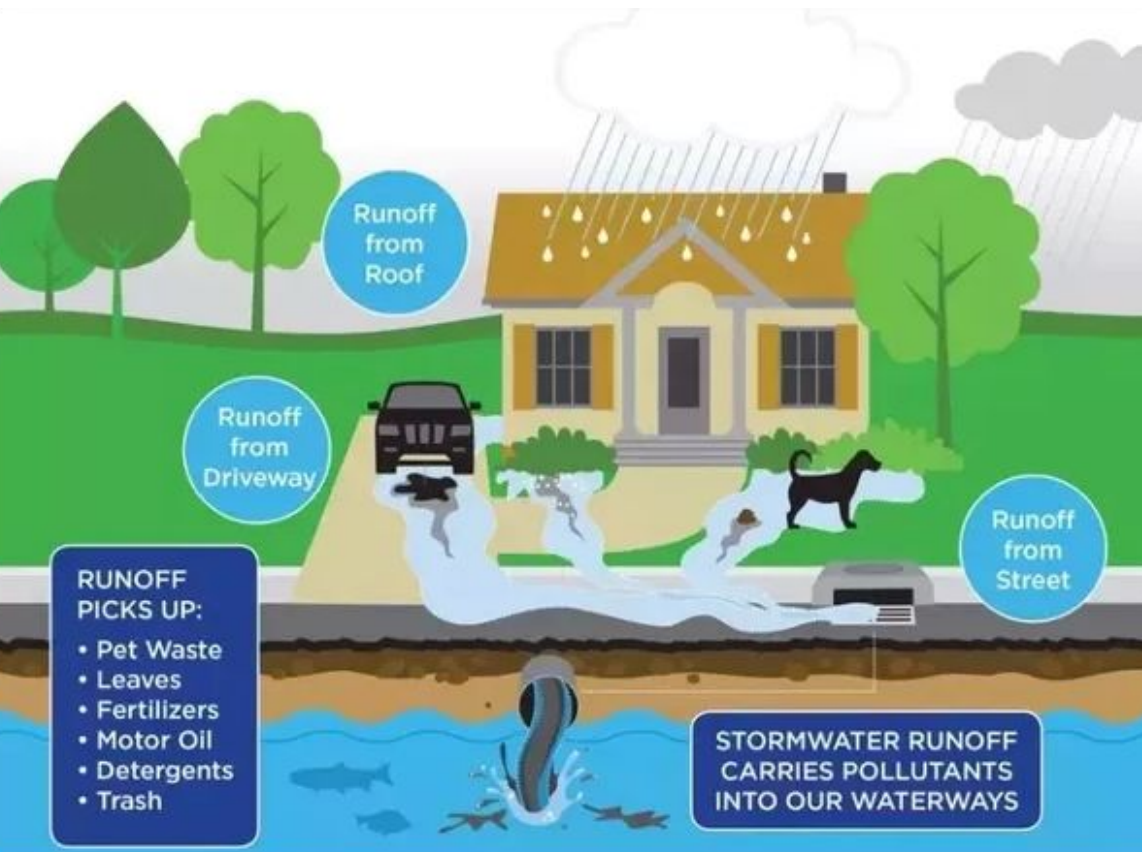


# Stormwater Maintenance Workshop

April 3, 2018



# What is Stormwater Runoff?



- Rainfall or melting snow that flows over any surface that is not allowed to soak into the ground including impervious (paved surfaces, rooftops) and pervious surfaces.
- As it flows, stormwater runoff collects and transports pollutants into a storm drain or stream.

Image source: Google





ANNAPOLIS MD



- Stormwater runoff is the fastest growing source of pollution to the Chesapeake Bay (*Chesapeake Bay Foundation*).
- Pollution carried by stormwater damages fisheries and habitat of plants and animals that depend on clean water for survival.
- Limits recreational uses of water bodies by making them unsafe for wading, swimming, boating and fishing.

Source: Bay Journal ([www.bayjournal.com](http://www.bayjournal.com))



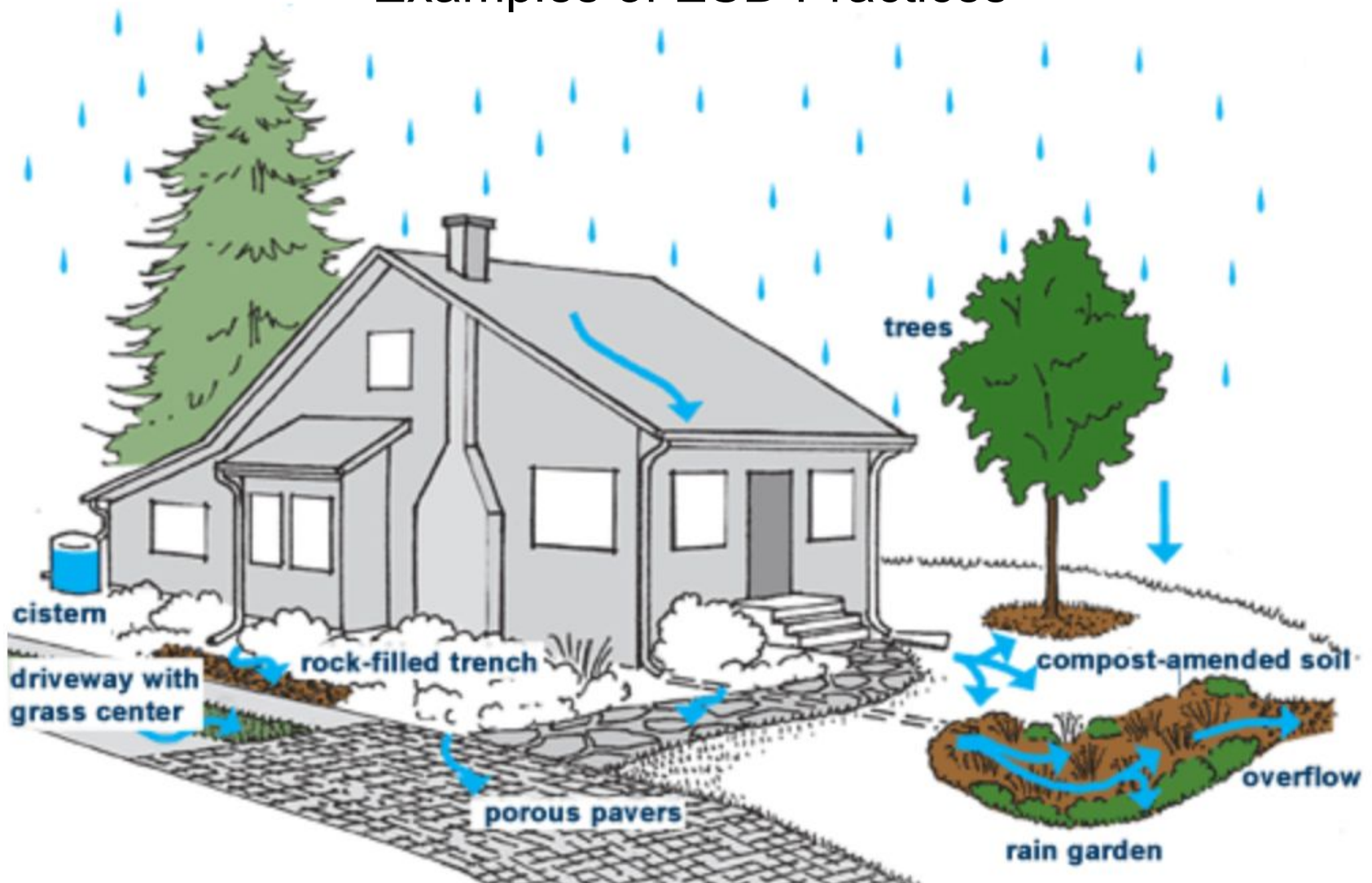
# Stormwater Management

- SWM helps reduce the impacts on the natural waterways by
  - Reducing chance for erosion
  - Reducing thermal impacts
  - Reducing nutrients like phosphorus and nitrogen
  - Reducing sediment
- Types of SWM
  - Structural Best Management Practices (BMPs) - Large Scale Practices that treat a larger drainage area
    - Typical for development pre-2007
  - Environmental Site Design (ESDs) - Small Scale Practices that treat runoff closer to the source
    - Typical for development post-2007





## Examples of ESD Practices





## Example of BMP Practices



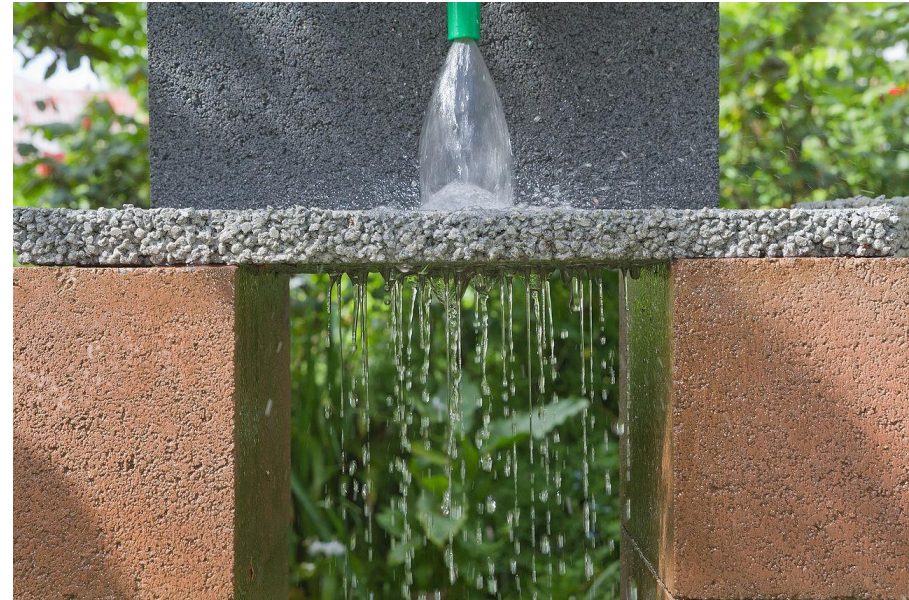
*Mars Run Road, Baltimore County*





## PERMEABLE PAVEMENT

- Permeable pavements are alternatives to traditional paving materials such as asphalt, compacted gravel, or concrete.
- Permeable pavement systems consist of either segmented permeable pavers, porous concrete, or pervious asphalt.
- Permeable pavements reduce pollutant runoff into waterways by allowing the water to move through the pavement so that the stormwater percolates into the ground.



*Permeable paver demonstration (From Wikipedia)*



# PERMEABLE PAVEMENT MAINTENANCE & MONITORING

FREQUENCY	ACTIVITY
Monthly or After a Rain Event	<ul style="list-style-type: none"><li>• Ensure pavement is free of weeds, sediment and debris.</li><li>• Ensure that water drains between storms.</li><li>• Clean with a leaf blower or similar equipment (avoid sanding, re-sealing, re-surfacing and power washing).</li></ul>
Winter	<ul style="list-style-type: none"><li>• Do not use permeable pavement surface to store piled snow from other areas.</li></ul>
Annually	<ul style="list-style-type: none"><li>• Look for deterioration (broken or cracking) of pervious pavement surface.</li><li>• Vacuum sweep to keep surfaces clean.</li></ul>





## PERMEABLE PAVEMENT TROUBLESHOOTING

Symptom	Possible Cause	Solution
Water ponding or flowing off pervious pavement.	Clogging due to leaf litter, sediment, or debris accumulation.	Sweep and/or vacuum surface. Make sure area draining to pervious pavement is not a source of debris, such as exposed soil. Follow manufacturer's recommendations.
Weeds or other vegetation growing in pervious pavement.	Pervious pavement has not been maintained frequently enough.	Manually remove weeds and vegetation. Do not use herbicides or other chemicals to reduce weed growth. Follow manufacturer's recommendations.
Pervious pavement still not draining rainwater after sweeping or vacuuming.	Surface is clogged by sediment.	Try more powerful vacuum or try gentle pressure washing. Follow manufacturer's recommendations.



## GREEN ROOFS

- Reduce stormwater runoff by capturing and storing rainwater which otherwise would land on an impervious rooftop.
- The structure must be able to handle extra weight.
- The roofs are designed to support plant growth and retain water only for plant uptake.
- Green roofs absorb heat and act as insulators for buildings, reducing energy needed to provide cooling and heating and reducing the "heat island effect" (U.S. EPA).



*Sharrow School, Sheffield*





# GREEN ROOFS MAINTENANCE & MONITORING

FREQUENCY	ACTIVITY
Spring	<ul style="list-style-type: none"><li>•Visually inspect and hand-weed every 2-3 weeks to prevent flowering and reseed</li><li>•Test soil and if results suggest, apply a slow-release fertilizer; avoid herbicides or pre-emergent weed control.</li><li>•Monitor plant health and replace plants as needed.</li></ul>
Summer	<ul style="list-style-type: none"><li>•Visually inspect and hand-weed as needed to prevent flowering and reseed.</li><li>•Note plants which are not thriving with natural precipitation; either irrigate or replant drought-tolerant plants if needed. Heat waves may warrant additional irrigation.</li></ul>
Autumn	<ul style="list-style-type: none"><li>•Visually inspect and hand-weed as many plants become dormant during colder temperatures, but weeds will continue to grow.</li><li>•If irrigation system was installed, drain and winterize by mid-October.</li><li>•Avoid fertilizers which may impact plant hardiness during the winter.</li></ul>
Annually	<ul style="list-style-type: none"><li>•Visually inspect the waterproof membrane for leaks and cracks.</li><li>•Inspect roof drains ensuring they are not overgrown; remove any accumulated organic matter or debris.</li><li>•Remember that the first year is the green roof's establishment period so ensure maintenance schedule is carefully followed. After year one, general maintenance will reduce.</li></ul>



## DISCONNECTION OF ROOFTOP & NON-ROOFTOP RUNOFF

**Disconnected Non-Rooftop** involves directing flow from impervious surfaces onto vegetated areas where it can soak into or filter over the ground.

**Disconnected Rooftop Runoff** involves directing flow from downspouts onto vegetated areas where it can soak into or filter over the ground.



Residential disconnection of rooftop runoff onto grass  
(source: Chesapeake Stormwater Network)





# DISCONNECTION OF ROOFTOP & NON-ROOFTOP RUNOFF MAINTENANCE & MONITORING

FREQUENCY	ACTIVITY
Seasonally	<ul style="list-style-type: none"><li>• Remove leaves, debris, and other foreign matter from rooftop drain.</li></ul>
Semi-annually	<ul style="list-style-type: none"><li>• Check for erosion and repair if necessary.</li><li>• Replenish mulch as needed.</li><li>• Repair or replace the damaged gutter and downspout.</li></ul>



# DISCONNECTION OF ROOFTOP & NON-ROOFTOP RUNOFF

## TROUBLESHOOTING

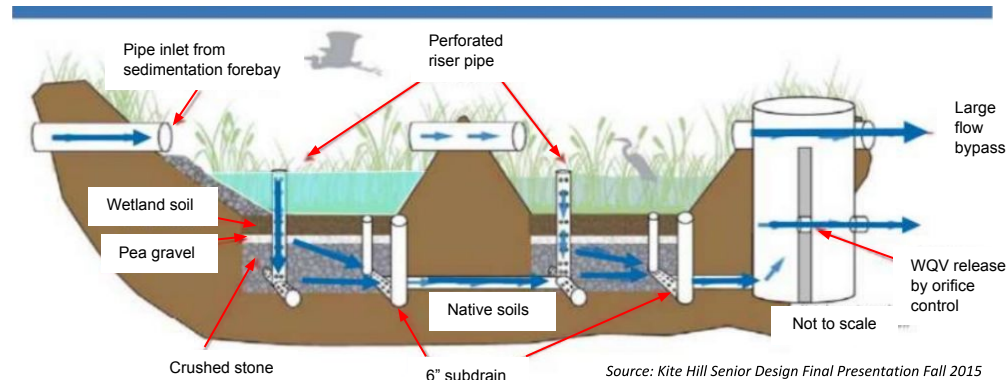
Symptom	Possible Cause	Solution
Sediment is accumulating in the infiltration area	Runoff collecting sediment may be occurring near the flow path or washing off paved surfaces.	Establish the longest overland flow path after disconnection at 40 to 75 feet to allow infiltration. Limit applications to areas with steep slopes.
Erosion	Flow path incorrect	Establish the longest overland flow path after disconnection at 40 to 75 feet to allow infiltration. Limit applications to areas with steep slopes.
Standing water	Clogging	If standing water occurs longer than 48 hours, the infiltration area may be clogged. Remove any accumulated leaves, organic materials and sediment.





## SUBMERGED GRAVEL WETLANDS

- A submerged gravel wetland is a small-scale filter using wetland plants in a rock media to provide water quality treatment.
- Runoff is dispersed throughout the system, and releases at the surface.
- Pollutant removal is attained through biological uptake from plants, algae and bacteria within the filter media.





# SUBMERGED GRAVEL WETLANDS

## MAINTENANCE & MONITORING

FREQUENCY	ACTIVITY
After every major storm	<ul style="list-style-type: none"><li>• Remove sediment accumulation (as necessary).</li><li>• Remove trash and debris accumulation (as necessary).</li></ul>
Semi-Annually	<ul style="list-style-type: none"><li>• Dredge sediment from wetland area to prevent the gravel base from becoming clogged, this may require removing and replacing gravel.</li><li>• Remove any invasive species.</li><li>• Replant wetland vegetation in poorly established areas.</li></ul>
Every 1 to 3 years	<ul style="list-style-type: none"><li>• Clear debris and clogging from inlets and outlets to each submerged wetland cell.</li><li>• Repair erosion at inflow/outflow points.</li></ul>





# SUBMERGED GRAVEL WETLANDS

## TROUBLESHOOTING

Symptom	Possible Cause	Solution
Stagnant water	Buildup of debris that blocks water flow paths	Remove any visible debris. Check to ensure that water is moving through all parts of the wetland. Ensure that debris does not block flow paths.
Dead or dying plants	Invasive species taking over planted vegetation	Regularly inspect vegetation. Remove invasive species. Herbicides should only be used for extreme circumstances.
Mosquitoes	Stagnant water	Ensure that water is moving through all parts of the wetland. Shade the water surface (mosquitoes avoid shaded water for egg laying).



## RAINWATER HARVESTING

- Rainwater harvesting is the practice of collecting and storing rainwater in large, durable containers, usually from rooftop gutters.
- Rainwater harvesting systems typically use a storage container such as a cistern, rain tank, or rain barrel for capturing rainfall for future use.
- Rainwater harvesting captures the first flush of stormwater, which contains the highest concentrations of pollutants.



Backyard rain barrel



# RAINWATER HARVESTING

## MAINTENANCE & MONITORING

FREQUENCY	ACTIVITY
Semi-Annually	<ul style="list-style-type: none"><li>• Remove any algae growth.</li><li>• Remove leaves and debris from gutters and downspouts.</li></ul>
Annually	<ul style="list-style-type: none"><li>• Clean storage tank lid.</li><li>• Repair any clogging.</li><li>• Repair mosquito screens.</li></ul>
Every 3 years	<ul style="list-style-type: none"><li>• Remove any sediment build-up.</li><li>• Clear overhanging vegetation and trees over roof.</li><li>• Repair integrity of backflow preventer, if applicable.</li><li>• Repair any damage to the structural integrity of tank and pipe.</li></ul>
As needed	<ul style="list-style-type: none"><li>• Replace damaged or defective system components</li></ul>





# RAINWATER HARVESTING

## TROUBLESHOOTING

Symptom	Possible Cause	Solution
Mosquitoes	Water allowed to sit in rain barrel too long.	A good way to prevent mosquito proliferation is to ensure that water is not allowed to remain undisturbed or pooled for more than a few days. Water should not be allowed to sit in the rain barrel for long periods of time. Also check for tears in mosquito screens
Stagnant water or algae growth	Water allowed to sit in rain barrel too long.	Empty rain barrels regularly. This will ensure that there is room in the barrel for future rain events and prevent undesired overflow.



## DRY WELLS / INFILTRATION TRENCHES

- Dry wells and infiltration trenches are normally gravel-filled trenches or pits capable of storing water on a temporary basis so as to allow enough time for the water to seep into the ground.
- Dry wells and infiltration trenches are conducive for treating runoff from small areas preferably less than 1000 SF for Dry wells and than five acres for infiltration trenches.

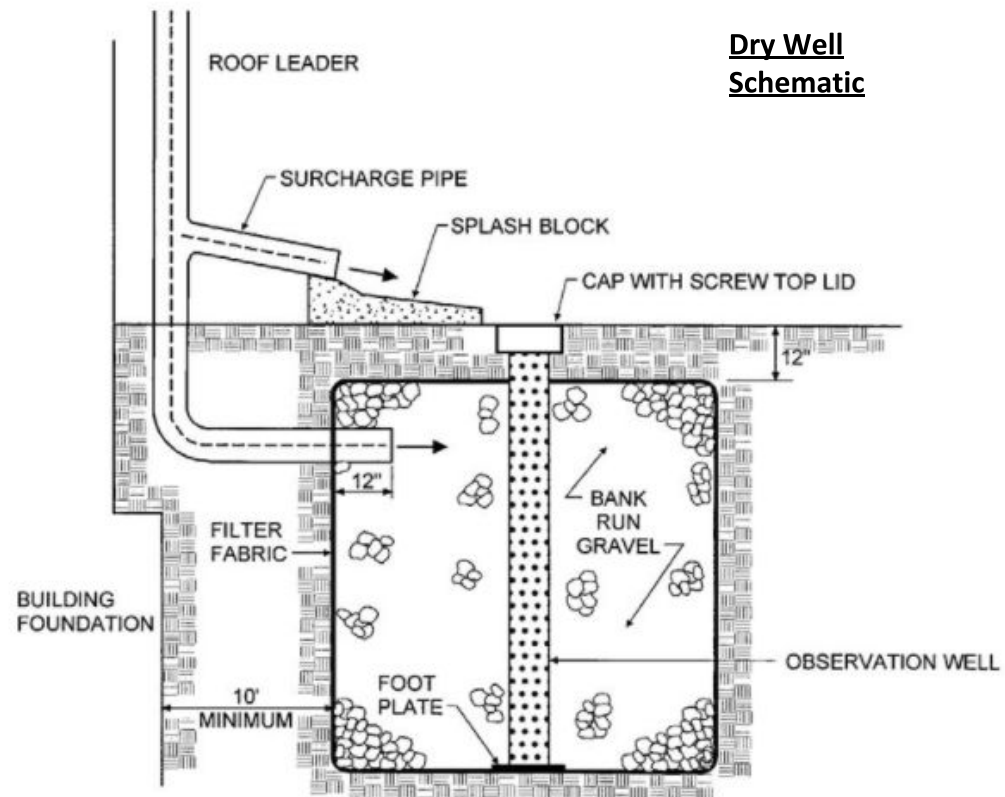


Diagram of a dry well  
(Source: Center for Watershed Protection)



# DRY WELLS / INFILTRATION TRENCHES

## MAINTENANCE & MONITORING

FREQUENCY	ACTIVITY
After storm events	<ul style="list-style-type: none"><li>• Observation wells should be inspected to make sure water is draining as expected (drainage should be complete within 48 hours after rain events).</li></ul>
Quarterly	<ul style="list-style-type: none"><li>• Ensure drainage area is stable and repair areas affected by erosion.</li><li>• Remove all debris from downspout channels leading to the system.</li></ul>
Monthly	<ul style="list-style-type: none"><li>• Check and remove any obstruction or blockage of flow along inflow areas or pipes in/out.</li><li>• Ensure the observation well cap is securely fastened.</li></ul>
Semi-annually	<ul style="list-style-type: none"><li>• Remove leaves and tree debris from roof gutters.</li></ul>
Annually	<ul style="list-style-type: none"><li>• Remove and replace filter fabric, gravel, and top soil if percolation is slow.</li></ul>





# DRY WELLS / INFILTRATION TRENCHES

## TROUBLESHOOTING

Symptom	Possible Cause	Solution
Standing water around the dry well/infiltration trench	If standing water occurs for more than 48 hours, the dry well/infiltration trench, filter fabric or underground piping may be clogged.	The gravel or underground piping may need to be cleaned or replaced.
Rainwater is immediately flowing into the overflow downspout at the start of a rain storm	The underground pipe or buried gravel may be clogged with sediment or leaf debris.	Remove any visible blockages in the downspout. Add stones at the overflow downspout to prevent erosion.
Rainwater is taking longer than usual to be absorbed by the dry well	The underground pipe or buried gravel may be clogged with sediment or leaf debris.	Remove any accumulated sediment, vegetation, or other debris. If still clogged after removing debris, remove and clear, or replace gravel and filter fabric. Assess reconstruction/retrofit options if clogging continues.



## SAND FILTERS

- Sand filters are typically a sand filled depression in the ground capable of treating and capturing pollution and excess runoff.
- An above-ground or open sand filter requires a sizable piece of land and it is ideal for areas with less urbanization.
- Compared to the above ground system, the below-ground sand filter is well suited for highly urbanized areas.





# SAND FILTERS

## MAINTENANCE & MONITORING

FREQUENCY	ACTIVITY
After Storm Event	<ul style="list-style-type: none"> <li>• Check and remove all sediment.</li> </ul>
Bi-Weekly	<ul style="list-style-type: none"> <li>• Inspect surrounding vegetation and make sure they are established.</li> </ul>
Monthly or As Needed	<ul style="list-style-type: none"> <li>• Cut or trim surrounding vegetation surrounding the sand filter.</li> <li>• Open and close dewatering valve regularly to prevent corrosion.</li> </ul>
Twice a Year	<ul style="list-style-type: none"> <li>• Check all components for debris, trash, and sediment.</li> <li>• Inspect surrounding vegetation and make sure they are great condition. Replace vegetation if needed and ensure that it is diverse.</li> <li>• Cut and remove debris from the sand in the system.</li> <li>• Remove all plantings growing in the system.</li> </ul>
Annually	<ul style="list-style-type: none"> <li>• Check structural components for cracking and deterioration.</li> <li>• Check area surrounding the system for erosion and stabilize.</li> <li>• Check surrounding vegetation and remove unwanted growth.</li> </ul>





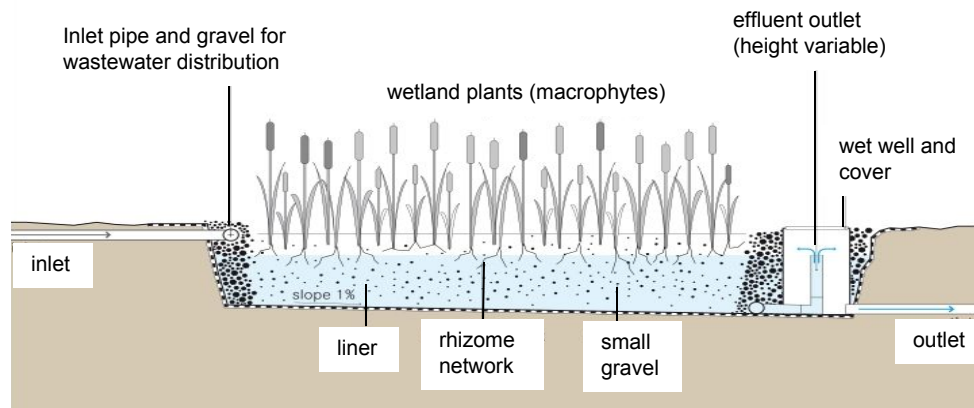
# SAND FILTERS TROUBLESHOOTING

Symptom	Possible Cause	Solution
Standing water in the surface sand filter	Clogging due to leaf litter, grass clippings, sediment, or debris accumulation.	If standing water occurs longer than 2 or 3 days, the surface sand filter may be clogged. Remove any visible debris from the area.
Rainwater is not flowing into the infiltration area	Leaves, sediment, or other debris may be blocking the flow path.	Remove any visible debris from the sand filter area and the flow path. Be sure to check that paved surfaces are also clear.
Sediment is accumulating in the surface sand filter	Erosion may be occurring near the flow path or washing off paved surfaces.	Stabilize any eroded areas with vegetation being careful not to block flow path. Be sure upstream paved surfaces are free of debris.



## CONSTRUCTED WETLANDS

- Wetlands treat waste stormwater physically and biologically.
- Physical removal of pollutants occurs as water moves slowly through the system as a result of resistance from plantings.
- Biological removal occurs when plants take up contaminants through their root system, break them down and release them into the atmosphere.



Source: *The online Compendium of Sanitation Systems and Technologies*



# CONSTRUCTED WETLANDS

## MAINTENANCE & MONITORING

FREQUENCY	ACTIVITY
One time – after first year	<ul style="list-style-type: none"><li>• Replant vegetation.</li></ul>
Monthly to Quarterly	<ul style="list-style-type: none"><li>• Mow embankments – minimum Spring and Fall.</li><li>• Remove debris.</li><li>• Repair undercut, eroded and bare soil areas.</li></ul>
Several times per hot/warm season	<ul style="list-style-type: none"><li>• Check mosquitoes by controlling plant population and water flow into the wetland.</li></ul>
Semi-annually to annually	<ul style="list-style-type: none"><li>• Set-up a trash and debris clean-up day.</li><li>• Remove invasive plants.</li><li>• Remove selected wetland plant materials or replant vegetation (as needed).</li><li>• Repair broken mechanical components if needed.</li></ul>
Every 1 to 3 years	<ul style="list-style-type: none"><li>• Complete forebay maintenance and sediment removal when needed.</li></ul>





# CONSTRUCTED WETLANDS

## TROUBLESHOOTING

Symptom	Possible Cause	Solution
Stagnant water	Buildup of debris that blocks water flow paths.	Remove any visible debris. Check to ensure that water is moving through all parts of the wetland. Ensure that debris does not block flow paths.
Dead or dying plants	Invasive species taking over planted vegetation.	Regularly inspect vegetation. Remove invasive species. Herbicides should only be used for extreme circumstances.
Mosquitoes	Stagnant water	Ensure that water is moving through all parts of the wetland. Shade the water surface (females avoid shaded water for egg laying).



## PONDS

- The two kinds of ponds are detention ponds, also known as dry ponds, and retention ponds, also referred to as wet ponds.
- Detention ponds can have the appearance of a well-manicured landscape or natural looking landscape.
- Wet ponds on the other hand experience fluctuation in water level due to precipitation and stormwater runoff.
- Retention ponds contain a pool of water all year round or sometimes during the wettest part of the year.



Retention Pond (Wet Pond)



## PONDS

### MAINTENANCE & MONITORING

FREQUENCY	ACTIVITY
One time – after first year	<ul style="list-style-type: none"><li>• Replant vegetation.</li></ul>
Monthly to Quarterly	<ul style="list-style-type: none"><li>• Mow embankments – minimum Spring and Fall.</li><li>• Remove debris.</li><li>• Repair undercut, eroded and bare soil areas.</li></ul>
Several times per hot/warm season	<ul style="list-style-type: none"><li>• Check mosquitoes by controlling plant population and water flow into the pond.</li></ul>
Semi-annually to annually	<ul style="list-style-type: none"><li>• Set-up a trash and debris clean-up day</li><li>• Remove invasive plants.</li><li>• Remove selected wetland plant materials or replant vegetation (as needed).</li><li>• Repair broken mechanical components if needed.</li></ul>
Every 1 to 3 years	<ul style="list-style-type: none"><li>• Pipe and riser repair as needed.</li><li>• Complete forebay maintenance and sediment removal when needed.</li></ul>





# PONDS

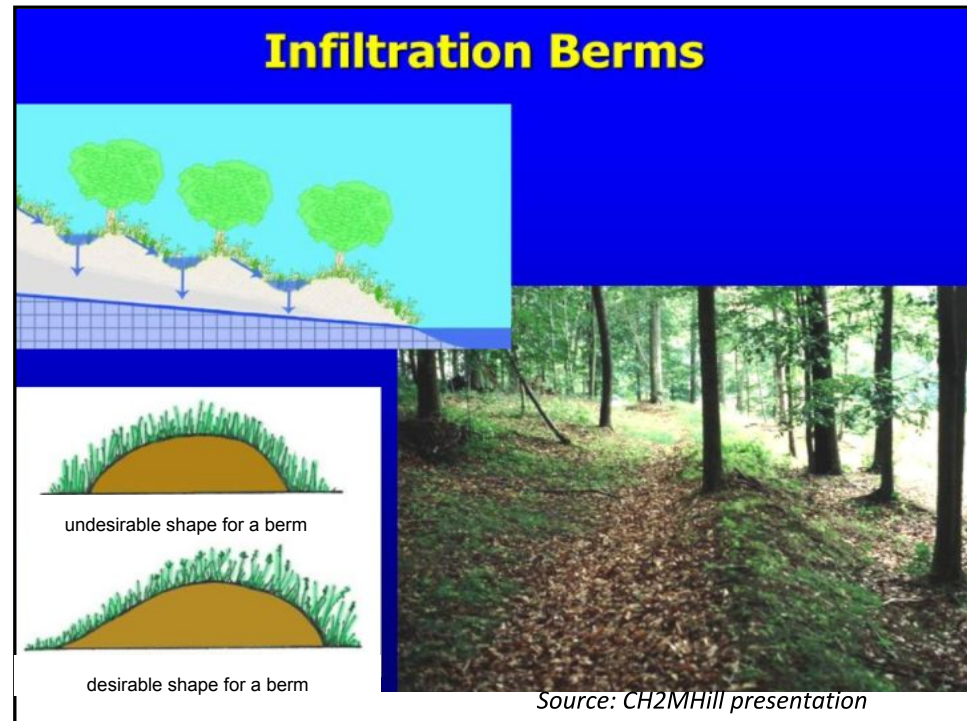
## TROUBLESHOOTING

Symptom	Possible Cause	Solution
Undercut, eroded, bare soil areas, and gullies in the bank	The side slope is too steep or incorrect plants or grass planted for the moisture or shade of the area.	Re-grade areas of gully formation and re-vegetate bare areas. Mow grassy areas on a regular basis.
Destabilized dams or embankments	Trees and brush with extensive root systems.	Remove trees and brush and replace with native vegetation or grass.
Mosquitoes	Stagnant water in a wet pond or water not infiltrating within 24-48 hours in a dry pond.	Perform frequent removal of the sediment, trash and debris that may clog the wet pond outlet/trash rack. In the case of a dry pond, remove built-up sediment.



## INFILTRATION BERMS

- Infiltration berms are mounds of stone covered with soil and vegetation placed along gentle slopes to slow the flow of water and encourage stormwater filtration.
- The main purpose is to slow the velocity of the flow and reduce the concentration of stormwater flows, reducing erosion and flood risk.





# INFILTRATION BERMS

## MAINTENANCE & MONITORING

FREQUENCY	ACTIVITY
As needed	<ul style="list-style-type: none"><li>• Remove litter and debris.</li><li>• Mow grass.</li><li>• Replace thinning or patchy vegetation.</li></ul>
Semi-annually, or more frequently (as needed)	<ul style="list-style-type: none"><li>• Ensure standing water does not persist longer than 48 hours, which would indicate the infiltration layer is clogged.</li></ul>
Annually, as needed	<ul style="list-style-type: none"><li>• Repair signs of erosion.</li><li>• Remove invasive/nuisance plant species.</li><li>• Eliminate any areas where excessive ponding is occurring to control vectors.</li></ul>
Every 10 years, or as needed	<ul style="list-style-type: none"><li>• If the infiltration ability of the berm(s) appear compromised (water pooling longer than 48-72 hours), the rock fill should be removed and replaced.</li></ul>





# INFILTRATION BERMS

## TROUBLESHOOTING

Symptom	Possible Cause	Solution
Poor grass health	Your grass may be the wrong type for your shade and moisture conditions or they may be smothered by weeds.	Remove dead or diseased grass and plant new vegetation as needed. Also be sure to regularly remove weeds and other invasive plants.
Standing water for over 48 hours after a rain event	Clogging due to leaf litter, grass clippings, sediment, or debris accumulation.	Remove any visible debris from the surface. Depending on severity, the berms may need to be tilled and replanted.
Erosion or bare soil	The rainwater is moving too fast and/or vegetation is lacking or nonexistent.	Stabilize the eroded areas by planting new vegetation. Consider using rocks to slow the flow of rainwater.



## SWALES

- Swales are designed to channelize and move stormwater while providing flow attenuation and removal of pollutants.
- Swales are ideal for use along roads and highways.
- Swales include:
  - Grass swale
  - Wet swale
  - Bio-swale
  - Dry swales



Grass Swale



# SWALES

## MAINTENANCE & MONITORING

FREQUENCY	ACTIVITY
Monthly or after a rain event	<ul style="list-style-type: none"><li>• Mow side slopes.</li><li>• Irrigation may be needed during dry periods.</li><li>• Look for dewatering within 48 hours after a rain event.</li><li>• Remove litter and debris.</li></ul>
Semi-annually, or more frequently (as needed)	<ul style="list-style-type: none"><li>• Remove litter and debris.</li><li>• Remove weeds.</li><li>• Remove accumulation of sediment.</li><li>• Trim woody vegetation at the beginning and end of the wet season.</li></ul>
Annually (as needed)	<ul style="list-style-type: none"><li>• Seed and sod to restore dead or damaged ground cover.</li><li>• Repair undercut or eroded areas and remove accumulated sediment.</li><li>• Eliminate any ponding areas that are causing vector concerns.</li><li>• Check all dams for structural issues and repair.</li><li>• Remove invasive/nuisance plants.</li></ul>





# SWALES

## TROUBLESHOOTING

Symptom	Possible Cause	Solution
Poor grass health	Your grass may be the wrong type for your shade and moisture conditions or they may be smothered by weeds.	Remove dead or diseased grass and plant new vegetation as needed. Also be sure to regularly remove weeds and other invasive plants.
Standing water for over 48 hours after a rain event	Clogging due to leaf litter, grass clippings, sediment, or debris accumulation.	Remove any visible debris from the surface. Depending on severity, the swale may need to be tilled and replanted.
Erosion or bare soil	The rainwater is moving too fast and/or vegetation is lacking or nonexistent.	Stabilize the eroded areas by planting new vegetation. Consider using rocks to slow the flow of rainwater.



## RAIN GARDENS AND OTHER MICRO-SCALE PRACTICES

- Rain Gardens are small, concaved landscape feature designed to capture and temporarily pond stormwater and allow it to filter into the soil over 24-48 hours.
- Micro-scale practices are used to capture and treat stormwater on-site in small areas, typically less than one acre in size.
- Micro-scale practices can be installed throughout an area to create a system that resembles natural drainage characteristics.
- Other micro-scale practices include:
  - Landscape infiltration
  - Micro-Bioretention



Rain Garden



Micro-Bioretention



# MICRO-SCALE PRACTICES

## MAINTENANCE & MONITORING

FREQUENCY	ACTIVITY
During the first year	<ul style="list-style-type: none"><li>• Replant any areas where the plants do not appear to be taking hold.</li></ul>
As needed	<ul style="list-style-type: none"><li>• If certain plants are not surviving, replace with more appropriate plants.</li><li>• Occasional pruning/replacement of dead vegetation is necessary.</li><li>• Watering is necessary during extended dry periods.</li><li>• If water ponds for longer than 48 hours or if algae growth is observed, the top few inches of planting soil/filter media should be removed and replaced.</li></ul>
Annually, as needed	<ul style="list-style-type: none"><li>• In areas where micro-scale practices are used to treat heavy metals (ex. roads, parking lots), replace the mulch bed annually.</li></ul>





# MICRO-SCALE PRACTICES

## TROUBLESHOOTING

Symptom	Possible Cause	Solution
Poor plant health	Your plants may be the wrong plant type for your shade and moisture conditions or they may be smothered by weeds.	Remove dead or diseased plants and plant new vegetation as needed. Also be sure to regularly remove weeds and other invasive plants.
Standing water for 2 or 3 days after a rain storm	Clogging due to leaf litter, sediment, or debris accumulation.	Remove any visible debris from the surface. If a bioretention area, where possible, inspect the perforated pipe for blockages.
Erosion or bare soil	The rainwater is moving too fast and/or vegetation is lacking or nonexistent.	Stabilize the eroded areas by planting new vegetation. Consider using rocks to slow the flow of rainwater.



## Additional Information:

Raycine M. Hodo  
Acting Director

Office of Environmental Policy  
City of Annapolis  
145 Gorman Street  
Annapolis, Maryland 21401

(410) 260-2200 ext. 7887

[rmhodo@annapolis.gov](mailto:rmhodo@annapolis.gov)

# Plant Invaders

- Since European settlement of America, 50,000 species have been introduced. **5,000** of those **have gone wild** to compete with 17,000 natives.
- Globalization has increased the amount and rate of spread of non-native species.
- Many were introduced for the benefits they offered, others were brought here accidentally.





# Definitions



**Native:** grow or evolved naturally; were not introduced by man; or existed in the US prior to European contact.

**Non-Native:** were introduced intentionally or accidentally by humans or human activities. **Not all are problematic.**

**Invasive:** a *non-native species* whose introduction causes economic or environmental harm or harm to human health.

**Aggressive:** a plant, native or non-native, that has heightened adaptive strategies and can quickly populate an area or outcompete nearby plants.

# Common Traits of Non-Native Invasives

- Multiply quickly & spread easily
- Grow/Mature rapidly
- Hardy – very adaptable to:
  - disturbance
  - Light & moisture levels
  - soil conditions
- Lack predators
- Early leaf-out or evergreen





# Why is this an issue?

- Outcompete natives
- Degrade habitat & food sources
- Reduce biodiversity
- Cost of damage and control (>\$140 billion/yr)
- Disease & Pest spread
- Change hydrology & soil chemistry
- Effect natural succession
- Impede recreational activities
- Impact fire susceptibility





# Least Wanted!

## Invasive Trees

Tree of heaven

Norway maple

Callery Pear

Mimosa Silktree

## Invasive Shrubs

Japanese barberry

Autumn olive

Privet

Bush honeysuckle

Multiflora Rose

Burning bush

## Invasive Vines

porcelain berry

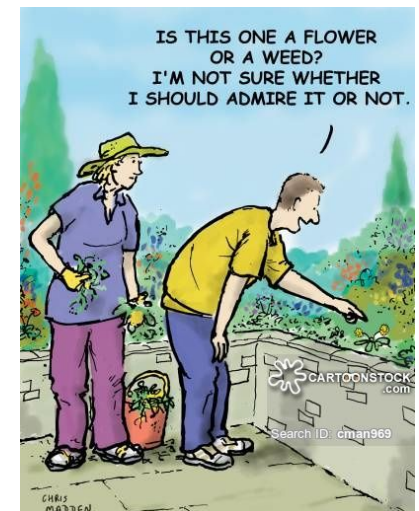
Oriental bittersweet

English ivy

Japanese honeysuckle

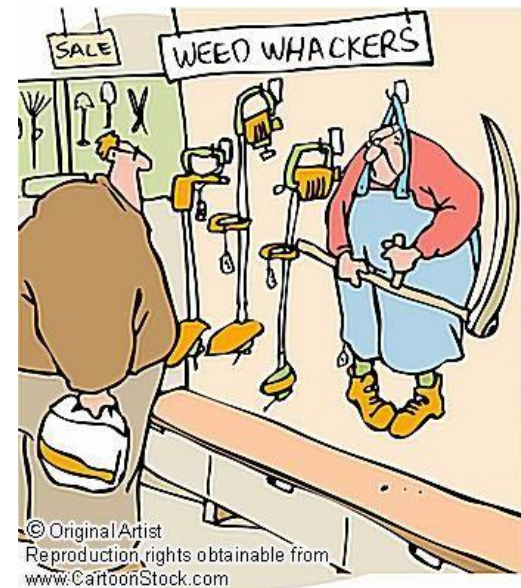
## Invasive Herbs

Phragmites (Common reed )



# What can be done?

- Only plant natives and avoid using invasives
- Recognize invasives and report new arrivals
- Prevent invasive spread by equipment
- Control & eradicate invasives
- Protect soil health
- Educate others



# For More Information or to contact Me



- *Claudia H. Donegan*
- *Chief, Center for Habitat Restoration and Conservation,  
Community Restoration Program,*
- *Chesapeake & Coastal Service*
  
- ***Department of Natural Resources***
- 580 Taylor Ave,
  
- Annapolis, MD 21401
- 410-260-8768 (office)
- 410-570-3911 (cell)
- [claudia.donegan@maryland.gov](mailto:claudia.donegan@maryland.gov)